(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 272 260 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
24.01.2018 Bulletin 2018/04

(51) Int Cl.:
A47K 13/30 *(2006.01)*

(21) Application number: **16180788.8**

(22) Date of filing: **22.07.2016**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(71) Applicant: **Duravit Aktiengesellschaft**
78132 Hornberg (DE)

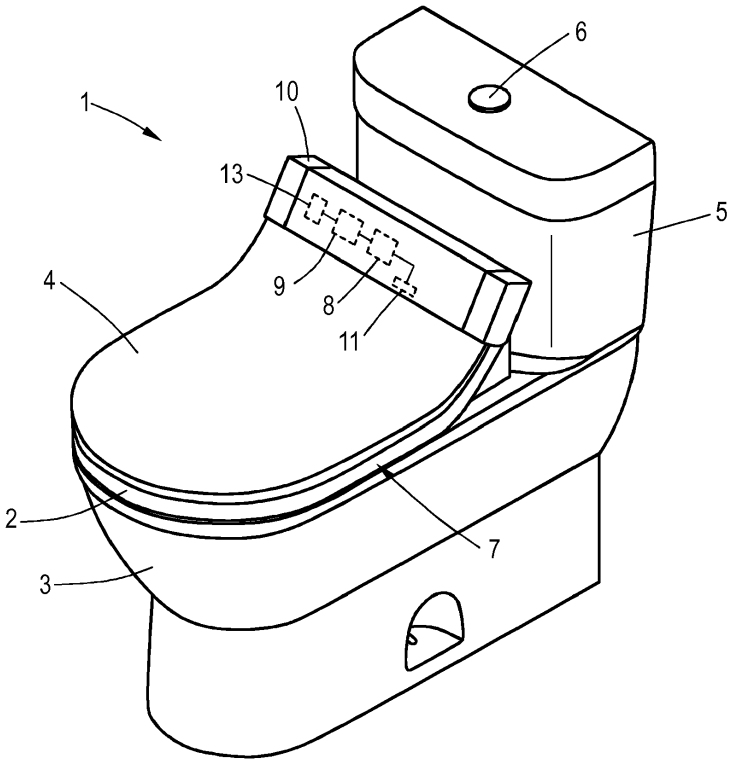
(72) Inventors:
- **Zhengxue, Yan**
  Shanghai (CN)
- **Chaobo, Lu**
  Shanghai, Shanghai (CN)
- **Long, Chen**
  Shanghai, Shanghai (CN)

(74) Representative: **Lindner Blaumeier**
Patent- und Rechtsanwälte
Partnerschaftsgesellschaft mbB
Dr. Kurt-Schumacher-Str. 23
90402 Nürnberg (DE)

(54) **SANITARY DEVICE SEAT AND SANITARY DEVICE**

(57) Sanitary device seat, comprising a ring- or U-shaped seat body (17) and at least one capacitive element (7) adapted to provide a sensing signal processible to a seat occupancy information, whereby the capacitive element (7) is arranged at the seat body (17) and covered by an overlay (18) coating the seat body (17).

FIG. 1



EP 3 272 260 A1

Description

[0001] The invention relates to a sanitary device seat, comprising a ring- or U-shaped seat body and at least one capacitive element adapted to provide a sensing signal processible to a seat occupancy information.

[0002] Many comfort features of modern sanitary devices, frequently called electric toilets or electric bidets, require an occupancy information describing whether the sanitary device seat is occupied or not. It is known to attach a microswitch to the sanitary device, whereby the microswitch is switched by a vertical displacement occurring when a user takes seat. Furthermore, it is known to arrange a capacitor module with a capacitive element and an integrated signal processing into the seat body. The capacitor module detects a change of the permittivity resulting from an approach of a human body to the sanitary device seat.

[0003] This kind of capacitive proximity sensing suffers from the large dimensions of known capacitor modules, requiring to divide the seat body into two pieces laterally, to arrange the capacitor module between them and to reassemble both pieces. Disadvantageously, the production of those sanitary device seats is very complex and the further reduction of the thickness of the sanitary device seat is rendered difficult.

[0004] Therefore, it is an object to the invention to provide a more easily manufacturable sanitary device seat of reduced thickness.

[0005] This is inventively achieved by a sanitary device seat as initially described, whereby the capacitive element is arranged at the seat body and covered by an overlay coating the seat body.

[0006] The invention bases on the consideration to place the capacitive element between the seat body specifying the basic form of the sanitary device seat, and the overlay, building an outer skin of at least parts of the sanitary device seat. Thus, the seat body may be only as thick as necessary to match mechanical stability requirements, whereby a particularly flat capacitive element may be arranged at the seat body and coated by the overlay, as well. Advantageously, this allows the sanitary device seat to be manufactured with a very small cross-sectional height. Additionally, the manufacturing process of the inventive sanitary device seat may be simplified significantly since dividing and reassembling the seat body, e.g. by welding, is avoided.

[0007] The capacitive element used for the inventive sanitary device seat should be chosen very thin, e.g. having a cross-sectional height which is at most a tenth, preferably at most a hundredth, of the cross-sectional height of the seat body. Particularly, the capacitive element may have a cross-sectional height between 10 μm and 1 mm. This allows the capacitive element to remain invisible from the exterior of the sanitary device seat when the seat body is coated with the respectively thin overlay. The capacitive element may be arranged directly on the surface of the seat body. Furthermore, the sanitary device seat may comprise a connector, arranged to connect the capacitive element from the exterior of the sanitary device seat. The connector may be adapted to provide an external electric signal to the capacitive element and/or to provide the seat occupancy information or a signal processible to the seat occupancy information to the exterior of the sanitary device seat. The ring-shaped sanitary device seat may be considered as O-shaped, as well, meaning that the seat fully surrounds an opening for a person to sit on, whereas the U-shaped seat does not surround the opening completely. A typical inventive sanitary device may also comprise a lid, attached to the sanitary device seat and adapted to cover the opening of the sanitary device seat in a closed position and/or to allow a user to sit on the sanitary device seat in an opened position.

[0008] Preferably, the capacitive element is or comprises a looped coil. Such a looped coil may be made of a thin wire being wounded one or several times on a free end, forming a capacitor structure whose capacitance may change due to an approach of an object having a relative permittivity significantly higher than 1, e.g. the human body. The other free end of the wire may be connected to the connector. Alternatively or additionally the capacitive element comprises or is a capacitive foil. Such a capacitive foil is comparable to those used for touch screens etc. The capacitive element may be or comprise a printed circuit, as well. The printed circuit may comprise a wiring made of an electrically conductive material forming a capacitor structure. Furthermore the capacitive element may be realized by laser direct structuring. This way, the capacitor structure may be drawn on the seat body by a laser and electroplated afterwards. Of course, a plurality of capacitive elements may be arranged at the seat body, particularly distributed over its surface.

[0009] Furthermore, the capacitive element may be glued on the seat body. This allows a very feasible arrangement and fixation of the capacitive element at the seat body. Alternatively or additionally the capacitive element is fixed by in-mold-decoration at the seat body. According to a very feasible embodiment of the inventive sanitary device seat, the capacitive element is fixed by the coating.

[0010] Advantageously, the seat body is made of one piece. As already mentioned, several steps required for the manufacture of conventional sanitary device seats may be saved, such as dividing and reassembling. Particularly, the seat body is free of joining seams.

[0011] Moreover, the sanitary device seat may have a thickness of the most 10 mm, preferably at most 7 mm, more preferably at most 5 mm, with a minimal thickness of 3 mm. Thickness may be defined as the sanitary device seat's cross-sectional height.

[0012] Particularly, the overlay is painted and/or glued and/or plated and/or laminated on the seat body. Those surface processing methods have been found out as very useful for a further simplification of the manufacturing process of the inventive sanitary device seat.

[0013] Additionally, the seat body may be made from a plastic material, particularly comprising polypropylene and/or acrylnitril-butadien-styrol and/or urea-formaldehyde resin, and/or a composite material and/or wood. Those materials are very suitable for the above-mentioned methods of fixing the capacitive element and/or realizing the overlay. However, the material of which to seat body is made is not limited to the aforementioned materials.

[0014] Aside, the invention relates to a sanitary device, comprising an inventive sanitary device seat.

[0015] A typical inventive sanitary device may also comprise a bowl, especially made of ceramics, to which the sanitary device seat is attached. Alternatively to the lid being attached to the sanitary device seat as mentioned above, the lid may be attached to the bowl. The sanitary device may be adapted as a toilet and/or for washing parts of the human body (bidet). The inventive sanitary device may furthermore comprise a connector adapted to fit to the connector of the sanitary device seat.

[0016] The inventive sanitary device may comprise a signal processing unit being adapted to determine the seat occupancy information depending on the sensing signal. The signal processing unit may be connected to the capacitive element, particularly via the connector of the sanitary device seat and/or the other connector. In general, the signal processing unit may be adapted to supply a voltage and/or a current to the capacitive element.

[0017] Preferably, the signal processing unit is adapted to apply an alternating, particularly rectangular or trapezoidal, current to the capacitive element. Particularly, if a passive capacitive element is used, e.g. the looped coil, the capacitive foil or a capacitive element realized by laser direct structuring, the temporary constant current will charge the capacitor realized by the capacitive element resulting in a nearly linear change of voltage dropping over the capacitive element. The magnitude of this change depends on the capacitance which depends again on the permittivity being changed by the object, e. g. the human body. Thus, a very reliable sensing signal is provided by the capacitive element.

[0018] Advantageously, the signal processing unit is adapted to measure a voltage dropping over the capacitive element as the sensing signal. The signal processing unit may additionally be adapted to evaluate this voltage and to determine the occupancy information basing on the evaluation result. The voltage is preferably the aforementioned voltage resulting from the applied current.

[0019] The signal processing unit or a respective signal processing unit may be arranged between the seat body and the overlay of the inventive sanitary device seat. In this case the capacitive element is or comprises the printed circuit and/or is integrated with the signal processing unit, preferably. Alternatively, the signal processing unit may be disposed outside the sanitary device seat. This allows the sanitary device seat to be composed merely of the coated seat body, the capacitive element and its connector, rendering a very thin realization of the sanitary device seat possible.

[0020] Referring to the inventive sanitary device, it may comprise a control unit being adapted to control at least one functional component of the sanitary device depending on the occupancy information. Preferably, the functional component is or comprises a spraying unit adapted to spray a liquid towards a human body sitting on the sanitary device seat and/or a blowing unit adapted to blow air towards a human body sitting on the seat and/or a heating unit adapted to heat the sanitary device seat and/or a flushing unit and/or a movement device adapted to close a lid of the sanitary device and/or a deodorization unit. However, the at least one functional component is not limited to the aforementioned devices.

[0021] Advantageously, a service device is arranged separately from the sanitary device seat and incorporating the control unit and/or the signal processing unit, which is disposed outside the sanitary device seat, in a housing. Providing the service device allows the sanitary device seat to have a reduced thickness of its entire dimensions. The connector fitting to the connector of the sanitary device seat may be attached to the service device.

[0022] Besides, a method for manufacturing a sanitary device seat is disclosed, comprising the steps: providing a seat body; arranging at least one capacitive element adapted to provide a sensing signal processible to a seat occupancy information at the seat body; and covering the seat body by an overlay coating it. A looped coil and/or a capacitive foil and/or a printed circuit may be used as capacitive element and/or the capacitive element may be realized by laser direct structuring. Arranging the capacitive element at the seat body may comprise gluing the capacitive element and/or fixing the capacitive element by in-mold-decoration at the seat body. Covering the seat body may comprise fixing the capacitive element by the coating. Furthermore, covering the seat body may comprise painting and/or gluing and/or plating and/or laminating the seat body. A seat body made of one piece and/or having a thickness of at most 10 mm, preferably 7 mm, more preferably 5 mm, with a minimum thickness of 3 mm, may be used.

[0023] All statements referring to the inventive sanitary device seat may apply analogously to the inventive sanitary device and the aforementioned method, so that advantages achieved by the inventive sanitary device seat may be achieved by the inventive sanitary device and the aforementioned method, as well.

[0024] In the following, the invention is described in detail, whereby references are made to the principle drawings, which show:

Fig. 1 a perspective view of an inventive sanitary device, comprising a first embodiment of an inventive sanitary device seat;

Fig. 2 a top view on a first embodiment of the

sanitary device seat shown in fig. 1;

Fig. 3 a cross-section of the sanitary device seat shown in fig. 2 along a line III-III;

Fig. 4 a block diagram of the sanitary device shown in fig. 1;

Fig. 5 time curves of the measured voltage provided by a capacitive element while a test process;

Fig. 6 a cross-section of a further embodiment of an inventive sanitary device seat; and

Fig. 7 and 8 each a top view on a further embodiment of an inventive sanitary device seat;

[0025] Fig. 1 shows a perspective view on a sanitary device 1, comprising a ring-shaped sanitary device seat 2 (in the following simply referred to as seat 2) which is arranged on a bowl 3. According to further embodiments the seat may be U-shaped. A lid 4 is attached pivotly to the seat 2 to cover it in a closed position and to allow a person to sit on the seat 2 in an opened position. The bowl 3 is connected to a sewer system and has a cistern 5 with an operating element 6 to initiate flushing. Within the seat 2 a capacitive element 7 is arranged adapted to provide a sensing signal processible by a signal processing unit 8 to a seat occupancy information. The signal processing unit 8 and a control unit 9 are incorporated in a housing of a service device 10 being arranged separately from the seat 2. A connector 11 of the service device 10 is connected to a further connector 12 (cf. Fig. 2) arranged at the seat 2, whereby the capacitive element 7 is connected to the signal processing unit 8 via both connectors 11, 12.

[0026] Besides, the sanitary device 1 comprises further functional components 13, which are not shown in detail for reasons of clarity. The functional components 13 are controllable by the control unit 9 and comprise a spraying unit adapted to spray a liquid towards the human body sitting on the seat 2, a blowing unit adapted to blow warmed air towards the human body, a heating unit adapted to heat the seat 2, a flushing unit adapted to flush the bowl 3 by allowing water from the cistern 5 to flow into the bowl 3, a movement device adapted to close the lid 4 and a deodorization unit. Note, that this enumeration is not exhaustive.

[0027] Fig. 2 shows a top view on the seat 2, comprising the capacitive element 7 and the connector 12 being connected to the external signal processing unit 8. The capacitive element 7 is a looped coil, made of a thin wire 14 which is wounded several times on a free end 15. The other free end 16 of the wire 14 is connected to the connector 12.

[0028] Fig. 3 shows a cross-section along a line III-III of the seat 2, having a thickness of 5 mm. As can be seen, the seat 2 comprises a seat body 17 made of one piece and of a plastic material, e.g. polypropylene, acrylnitril-butadien-styrol, urea-formaldehyde resin, a composite material, wood or a combination thereof. Note, that this enumeration is not exhaustive. The wire 14, particularly its winding visible in fig. 3, is placed on the surface of the seat body 17 within grooves and glued thereon. The seat body 17 and the capacitive element 7 are covered by an overlay 18 coating the side of the seat body 17 on which the capacitive element 7 is arranged. The overlay 18 is painted on the seat body 17.

[0029] Fig. 4 shows a block diagram of the sanitary device 1. The wire 14 is connected to the signal processing unit 8 providing the seat occupancy information to the control unit 9 which controls the functional components 13. In the unoccupied state of the seat 2 the capacitive element 7 may be modeled by a capacitance C_{Base} being connected to ground. It has to be noted, that there is no mechanical connection to an object realizing ground potential, but that the wire 14 is a capacitor structure which forms a capacitor with a virtual capacitor structure on ground potential in the environment of the wire 14 having the total capacitance $C_{total} = C_{Base}$.

[0030] When an object, particularly the body of a person taking seat, with a relative permittivity significantly greater than 1 approaches the capacitive element 7 or the wire 14, respectively, its total capacitance C_{total} increases. This is modeled by an additional capacitance C_{Body} connected in parallel to the capacitance C_{Base} and two coupling capacitances C_x and C_f. In practice, the capacitances C_x and C_f have only a small influence on the total capacity, which can thus be approximated by $C_{total} \approx C_{Base} + C_{Body} > C_{Base}$ in the occupied state of the seat 2.

[0031] The signal processing unit 8 is adapted to apply a rectangular current to the capacitive element 7, which charges and discharges it, and to measure a voltage U_m dropping over the capacitive element 7. During one pulse of the rectangular current with a constant intensity I_S the voltage U_m increases linearly with the time. This can be modeled by the term

$$U_m(t) = C_{total}^{-1} \cdot I_s \cdot t$$

[0032] Thus, U_m increases faster in the unoccupied state of the seat 2 than in the occupied state, since C_{total} is lower in the unoccupied state than in the occupied state.

[0033] Fig. 5 shows time curves of the voltage U_m measured while a test process, in which a constant current is applied to the capacitive element 7 for 3 μs. As can be seen in the left curve showing the unoccupied state of the seat 2, the voltage U_m increases up to 4,4 V. By contrast, in the occupied state the voltage U_m only increases up to 3,2 V, making it possible for the signal processing unit 8 to clearly distinguish both occupancy

states of the seat 2 by evaluating the voltage U_m. Basing on this evaluation result, the signal processing unit 8 determines the occupancy information which is provided to the control unit 9. Therefore, the signal processing unit 8 compares the measured voltage U_m with a threshold value U_{th} which may be chosen to 4,0 V, whereby the seat 2 is assumed to be occupied if $U_m < U_{th}$. Note, that the specific voltage values refer to an exemplary configuration and may be different in other configurations of the capacitive element 7. In practice, the threshold value is saved in a memory of the signal processing unit 8. According to other embodiments, the threshold value may be derived from a user input into an input device of the sanitary device 1 describing a desired sensitivity of occupancy sensing.

[0034] Depending on the occupancy information provided by the signal processing unit 8 the control unit 9 activates and deactivates the functional competence 13. E.g. if the occupancy information indicates, that the seat 2 is no longer occupied, the control unit 9 activates the flushing unit, activates the movement device to close the lid 4 and activates the deodorization unit. On the contrary, if the occupancy information indicates the seat 2 being occupied, the control unit 9 will activate the heating unit, the spraying unit and the blowing unit. Particularly, the heating unit is deactivated when the seat 2 is detected to be unoccupied again. Of course, other conditions may be considered by the control unit 9 when controlling the functional components 13.

[0035] Fig. 6 shows a cross-section of the further embodiment of the seat 2 which differs from fig. 3 in that, grooves in the seat body 17 are omitted and the overlay 18 surrounds the wire 14. Additionally, the overlay 18 coats the entire circumference of the seat body 17.

[0036] Fig. 7 shows a top view on a further embodiment of the seat 2 which differs from fig. 2 in that the capacitive element is a capacitive foil glued or laminated on the seat body 17.

[0037] Fig. 8 shows a top view on a further embodiment of the seat 2 which differs from fig. 2 in that the capacitive element 7 comprises an a printed circuit realizing the signal processing unit 8, as well. Thus, the signal processing unit is not arranged within the service device 10, so that the occupancy information determined by the seat-side signal processing unit 8 is provided to the control unit 9 directly via the connector 12.

[0038] According to another embodiment, the capacitive element 7 is realized by laser direct structuring on the seat body 17 or fixed by in-mold decoration at the seat body 17. According to yet another embodiment, the overlay 18 is glued and/or plated and/or laminated on the seat body 17. Therefore, the overlay 18 may be a foil.

[0039] According to another embodiment, the sanitary device 1 is a bidet, allowing a person sitting on the seat 2 to wash his body.

Claims

1. Sanitary device seat, comprising a ring- or U-shaped seat body (17) and at least one capacitive element (7) adapted to provide a sensing signal processible to a seat occupancy information, **characterized in that** the capacitive element (7) is arranged at the seat body (17) and covered by an overlay (18) coating the seat body (17).

2. Sanitary device seat according to claim 1, **characterized in that** the capacitive element (7) is or comprises a looped coil and/or a capacitive foil and/or a printed circuit and/or is realized by laser direct structuring.

3. Sanitary device seat according to claim 1 or 2, **characterized in that** the capacitive element (7) is glued and/or fixed by in-mold-decoration at the seat body (17) and/or fixed by the coating.

4. Sanitary device seat according to one of the preceding claims, **characterized in that** the seat body (17) is made of one piece.

5. Sanitary device seat according to one of the preceding claims, **characterized in that** it has a thickness of at most 10 mm.

6. Sanitary device seat according to one of the preceding claims, **characterized in that** the overlay (18) is painted and/or glued and/or plated and/or laminated on the seat body (17).

7. Sanitary device seat according to one of the preceding claims, **characterized in that** the seat body (17) is made from a plastic material, particularly comprising polypropylene and/or acrylnitril-butadien-styrol and/or urea-formaldehyde resin, and/or a composite material and/or wood.

8. Sanitary device, comprising a sanitary device seat (2) according to one of the preceding claims.

9. Sanitary device according to claim 8, **characterized in that** a signal processing unit (8) is adapted to determine the seat occupancy information depending on the sensing signal.

10. Sanitary device according to claim 9, **characterized in that** the signal processing unit (8) is adapted to apply an alternating, particularly rectangular or trapezoidal, current to the capacitive element (7).

11. Sanitary device according to claim 9 or 10, **characterized in that** the signal processing unit (8) is adapted to measure a voltage dropping over the capacitive element (7) as the sensing signal.

12. Sanitary device according to one of the claims 9 to 11, **characterized in that** the signal processing unit (8) is disposed outside the sanitary device seat (2) or arranged between the seat body (17) and the overlay (18).

13. Sanitary device according to one of claims 8 to 12, **characterized in that** a control unit (9) is adapted to control at least one functional component (13) of the sanitary device (1) depending on the occupancy information.

14. Sanitary device according to claim 13, **characterized in that** the functional component (13) is or comprises a spraying unit adapted to spray a liquid towards a human body sitting on the sanitary device seat (2) and/or a blowing unit adapted to blow air towards a human body sitting on the sanitary device seat (2) and/or a heating unit adapted to heat the sanitary device seat (2) and/or a flushing unit and/or a movement device adapted to close a lid (4) of the sanitary device (1) and/or a deodorization unit.

15. Sanitary device according to one of the claims 9 to 14, **characterized in that** a service device (10) is arranged separately from the sanitary device seat (2) and incorporating the control unit (9) and/or the signal processing unit (8), which is disposed outside the sanitary device seat (2), in a housing.

FIG. 1

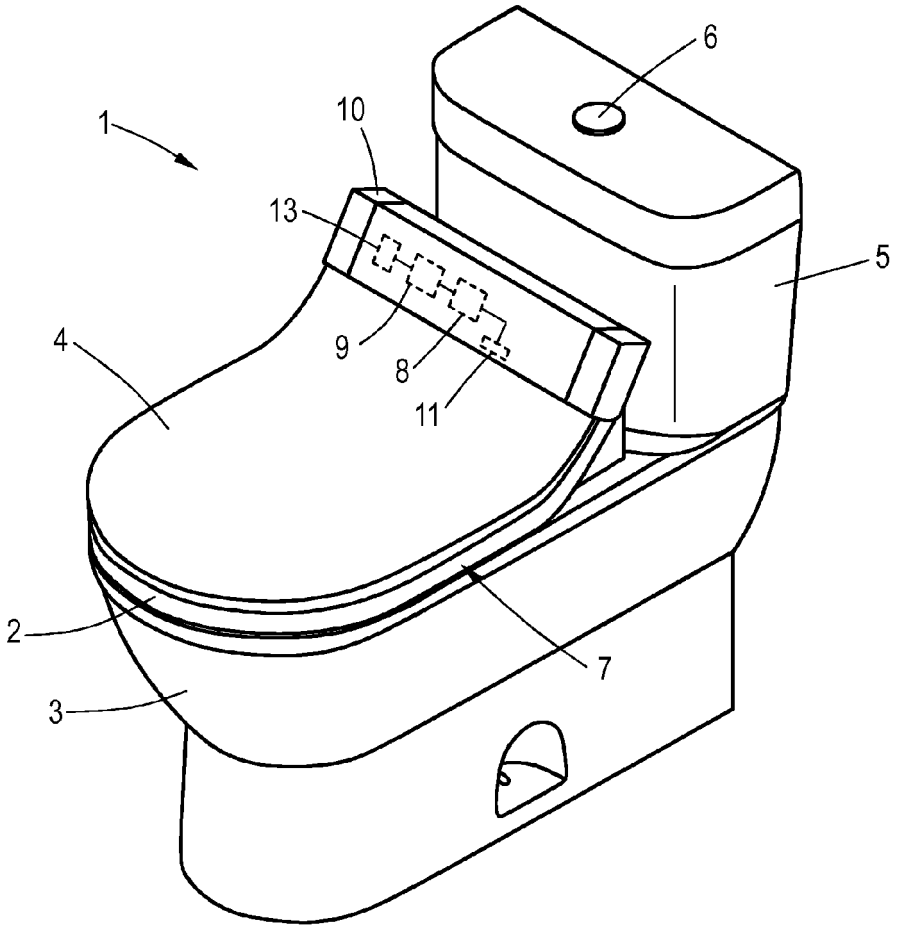


FIG. 2

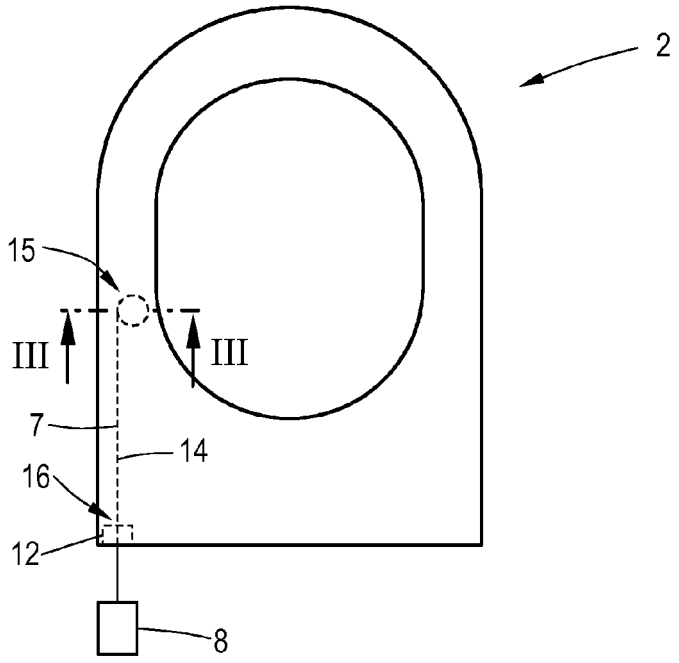


FIG. 3

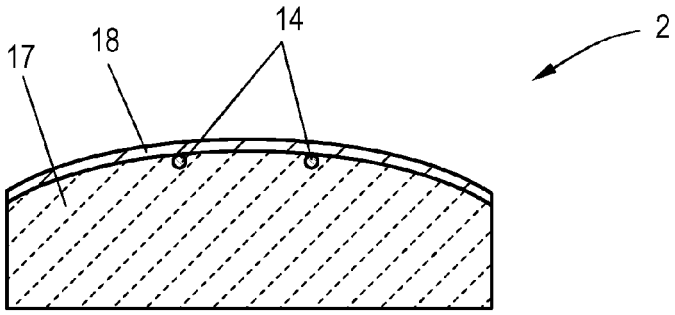


FIG. 4

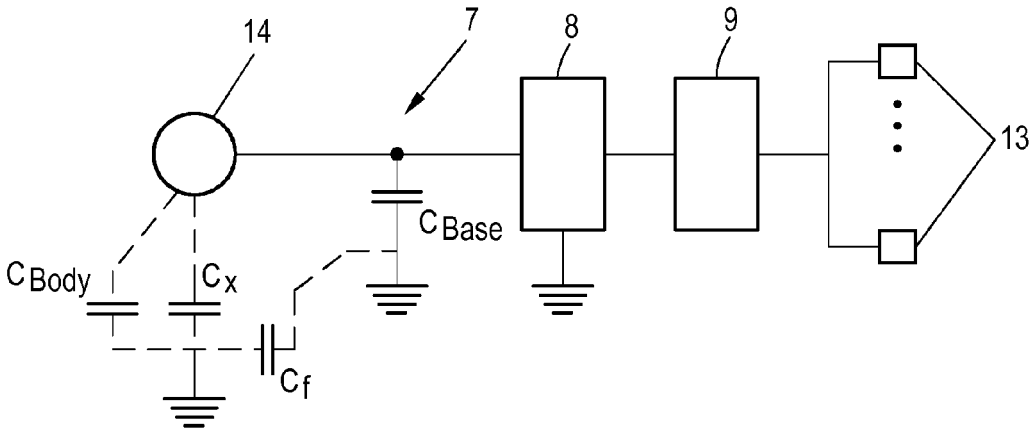


FIG. 5

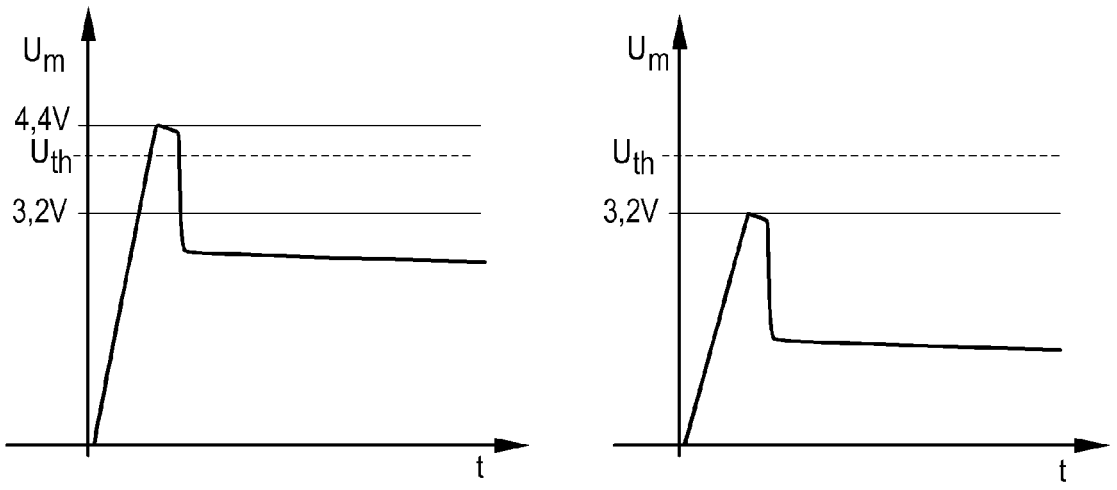


FIG. 6

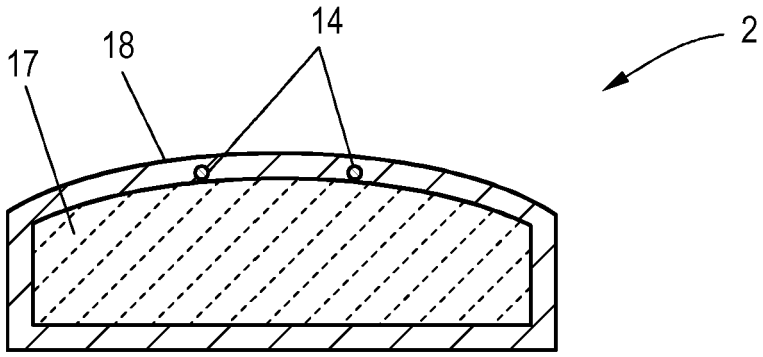


FIG. 7

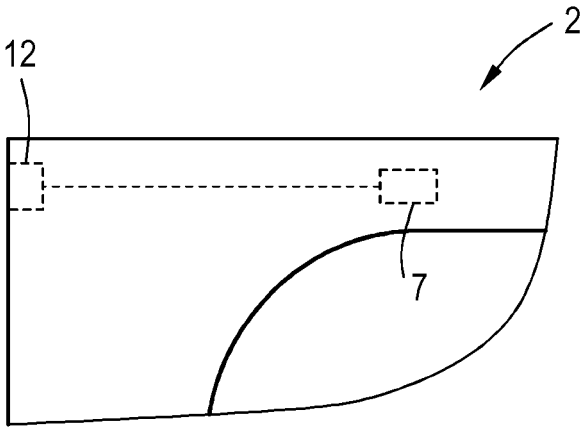
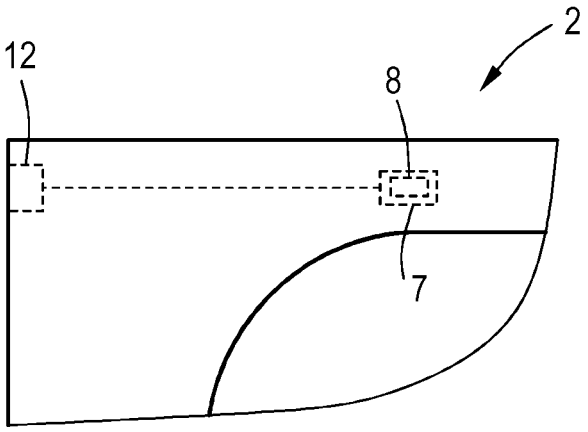


FIG. 8



Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 16 18 0788

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 10 2015 112819 A1 (HAMBERGER INDUSTRIEWERKE GMBH [DE]) 4 February 2016 (2016-02-04) * paragraphs [0045], [0049], [0062]; figures 1, 3 *	1-15	INV. A47K13/30
X	JP H05 293060 A (MATSUSHITA ELECTRIC WORKS LTD) 9 November 1993 (1993-11-09) * figure 5 *	1-15	
A	JP 3 427618 B2 (OMRON TATEISI ELECTRONICS CO) 22 July 2003 (2003-07-22) * figures 1, 2 *	2	
A	US 2014/047629 A1 (STAUBER JOSEPH L [US] ET AL) 20 February 2014 (2014-02-20) * paragraph [0052] *	2	
A	KR 2010 0007389 A (WOONGJIN COWAY CO LTD [KR]) 22 January 2010 (2010-01-22) * paragraphs [0031], [0034] *	2	

TECHNICAL FIELDS SEARCHED (IPC)

A47K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 December 2016	Schikhof, Arnout

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 16 18 0788

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

14-12-2016

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 102015112819 A1	04-02-2016	DE 102015112819 A1	04-02-2016
		WO 2016020409 A1	11-02-2016
JP H05293060 A	09-11-1993	NONE	
JP 3427618 B2	22-07-2003	JP 3427618 B2	22-07-2003
		JP H09327420 A	22-12-1997
US 2014047629 A1	20-02-2014	CN 101715313 A	26-05-2010
		EP 2155029 A1	24-02-2010
		US 2008271231 A1	06-11-2008
		US 2014047629 A1	20-02-2014
		WO 2008133804 A1	06-11-2008
KR 20100007389 A	22-01-2010	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82